COMPARISON BETWEEN FUZZY AND NON-FUZZY CLASSIFICATION METHODS IN THE PREDICTION OF RESIDENTIAL HOUSEHOLD WATER LEAKAGE

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PEMENANG Anugerah Kualiti Perdana Menteri 2008

Ruj. Kami : 600-RMI/ST/DANA 5/3/Dst (72/2010)
Tarikh : 14 November 2011

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Puan

KELULUSAN PERMOHONAN PELANJUTAN TEMPOH PENYELIDIKAN KALI PERTAMA

Tajuk Projek	:	Comparison of Fuzzy Rule-Based Algorithm With Non-Fuzzy Rule-Based Algorithm in Prediction of Residential Household's Water Leakage
Kod Projek	:	600-RMI/ST/DANA 5/3/Dst (72/2010)
Ketua Projek	:	Pn Nor Aishah Md Noh

Dengan segala hormatnya, perkara di atas adalah dirujuk.

2. Institut Pengurusan Penyelidikan (RMI) telah menerima dan **meluluskan** permohonan pelanjutan tempoh penyelidikan kali pertama daripada puan mulai 31 Oktober 2011 sehingga 31 Januari 2012 selama tiga (3) bulan sahaja. Oleh yang demikian, puan diminta menyiapkan dan menamatkan projek penyelidikan di dalam tempoh tersebut.

3. Disamping itu juga, puan perlu berusaha untuk membentang dan menerbitkan kertas kerja di dalam prosiding atau jurnal yang berindeks Scopus / ISI atau mempatenkan kerja penyelidikan puan sebagai salah satu hasil utama penyelidikan.

4. Sehubungan itu, RMI berharap pihak puan dapat memberikan kerjasama untuk menamatkan dan menyempurnakan projek penyelidikan serta menggunakan keseluruhan peruntukan perojek penyelidikan dengan penuh kebijaksanaan dengan mengikut mengikut garis panduan yang telah ditetapkan dalam surat kelulusan RMI sebelum ini.

Sekian, harap maklum dan terima kasih.

Yang benar

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5. Report

5.1 Proposed Executive Summary

Residential household's water leakage seems to be a secondary problem although it has been reported to contribute greater water losses compared to losses from the service pipes. The use of sophisticated devices is very expensive to be implemented either by the service provider or by the consumers. On the other hand, manual detection done by the service provider can be very time consuming and costly as the tasks should be carried out regularly. Obviously it is timely for new alternative approaches to tackle this issue. Additionally, although there are many mathematical approaches have been proposed, it can be observed that none of them is currently being implemented successfully to handle residential household's water leakage problems. Therefore this research looks into the potential use of fuzzy rule-based approaches from a new perspective where mathematical models generated using data related to water collected from the consumer consumption.

The aim of this research is to predict residential households water leakage using models created based on training data with fuzzy rule-based and non-fuzzy rule-based algorithms available in WEKA Machine Learning Software (Witten and Frank, 2005). The outcome is the prediction on the existence of residential household water leakage. Data on consumer water demand will be collected through interviews (face to face). Comparison of prediction results are obtained from each classification algorithm in order to come up with the final conclusion on which property has water leakage problem. The outcomes of this research can be used for further research on searching the best method to predict residential household's water leakage. Additionally, it also can be used by water supplier company to conduct house visit to detect the existence of water leakages.

Various fuzzy methodss have been investigated to overcome residential household's water leakage. Most of the researches done focused on the technical issues such as pipes diameter, water flow rate, pipes materials and so on, rather than on consumer water consumption and demand. Therefore, it is impossible to implement by customers since the data are difficult to be obtained. Additionally, most of the previous models are lack of practicality and very costly to be implemented either by the consumer or by the service provider. Hence, searching of the alternative approaches need to be done especially based on the perspective of consumer.

5.2 Enhanced Executive Summary

Residential household water leakage seems not to be a serious problem for resident lives in Malaysia especially in Negeri Sembilan, even it was the secondary problem among the water problems. A lot of sophisticated devices had been used to detect the water leakage which are costly and involving the technical issue (e.g pipes diameter, water flow, pipes material and so on). Data collection obtained from the resident in Negeri Sembilan, Malaysia used as a validation of algorithms and had been analyse as the water consumption of residential household. The variables used to predict the water consumption were bath shower, shaving, face and hand wash, toilet flush, washing machine, hand washing, cooking, car washing and outdoor usage. The fuzzy rule-based models are utilized to predict residential household water leakage and comparing the outcome with the non-fuzzy rule-based outcome in WEKA Machine Learning Software. The fuzzy rule-based algorithms that had been discussed deeply were Fuzzy Rough Neural Network (FRNN), Neural Network (NN), Fuzzy Neural Network (FNN), Fuzzy Ownership Neural Network (FONN) and VQNN. The non-fuzzy rule-based algorithms that had been used were PART Decision List (PDL), Multilayer Perceptron (MP), Multiclass Classifier (MCC), Pruned or Unpruned C4 Decision Tree (J48) and Random Forest (RF) since it shows the best algorithms to predict the residential household water leakage.